had prevailed over this state during the past sixty days was broken in this section, and over the state generally, by a heavy rain which began at 3.50 p.m. and continued until after midnight. The damage done by the drought is very great throughout the state. The crops of hay, oats, corn, potatoes, and wheat are far below the average. Owing to the dry weather severe forest fires prevailed for several weeks in the northern part of the state, doing great damage to farms, timber property, and cranberry marshes. Several villages were partly destroyed by the fires, and others damaged. A large number of farm houses and saw mills were burned.

Lansing, Michigan: heavy rain fell on the 21st, 1.12 inches, and on the 28th and 29th, 3.45 inches. As a result of the long drought which existed previous to these rains, pastures in this vicinity are dry and farmers are obliged to feed their cattle with hay.

Liberty Hill, Bienville parish, Louisiana: drought has prevailed here from the 27th of July until the 25th of August, and will decrease the yield of cotton.

Mexico, Audrain county, Missouri: the first rain since June 26th fell on the afternoon of the 12th. The rain was of great benefit to farmers, whose crops were suffering from drought.

Dallas, Texas, 27th: Stevens, Shackelford, Young, Palo, Pento, Throckmorton, Eastland, and Baylor counties are still suffering from drought. Some parts of these counties are entirely denuded of grass, and cattle are dying in large numbers.

Thornville, Lapeer county, Michigan: although several light rains fell during the month, the drought was not broken until the night of the 29–30th when 1.20 inches fell.

J. W. Sanborn, Secretary of the "State Board of Agriculture" for Missouri, makes the following report in reference to the drought:

> Corn has gone steadily down for August, and its general condition is now sixty-one per cent. Drought and heat have been general over the state, and the few short rains were inadequate to break it. The crop is now made and will not materially change. All other crops and pastures have suffered from drought.

Abilene, Texas, 31st: the drought in this section is over; copious rains have fallen during the month in the surrounding country, with a few showers at this place.

Lawrence, Douglas county, Kansas: the July drought was broken on the 1st by a copious shower. There were seven other serviceable rains during the month, but no rain sufficiently heavy to wet the ground to a greater depth than two inches.

The observer at Topeka, Kansas, reports, concerning the drought, as follows:

> August has been a very warm month in Topeka. Such long continued warm weather has not occurred during the past eight years. When this is considered with reference to the hot July it is not surprising that the effects of the drought are severe. Corn in many fields, especially the late planted, is worth little except for fodder. Likewise all crops that depend upon July and August weather for maturing have suffered severely. The rains of August would have sufficed for the crops had July left us better prepared or had the heat and hot winds been less intense. Western Kansas has, contrary to common experience, been comparatively more favored with rain than the eastern part of the state.

EARTHQUAKES.

Report on the Charleston Earthquake.

[By Prof. T. C. MENDENHALL, Assistant.]

The earthquake of August 31st, which, from the locality in which its greatest power was displayed, will generally be known as the "Charleston Earthquake," was, perhaps, the most notable disturbance occurring within the limits of the United States of which we have any knowledge. It is entitled to this rank both on account of the wide area over which it was distinctly felt, and of the magnitude of the disaster which it caused in the immediate vicinity of the point of maximum intensity.

The earthquake consisted of a series of seismic disturbances which began in slight but distinctly noticeable tremors occurring on August 27th and 28th, at the town of Summerville, about twenty-five miles northwest of Charleston, South Carolina.

The shock of greatest violence occurred a little before ten o'clock on the night of Tuesday, August 31st. It was followed by several of lesser magnitude on that night, and during the succeeding three or four weeks. The great shock began in the city of Charleston within a few seconds of 9.51 *p. m.*, 75th meridian time. The duration of the vibratory motion of the earth at that point was probably about forty seconds; the motion at first being moderate, but increasing with great rapidity during the last ten or fifteen seconds.

All of the loss of life and property during the whole series of disturbances is to be attributed to this first shock. Five minutes later another occurred, and ten minutes later still another; the latter being of considerable violence, but neither alone would have done any damage. The same may be affirmed of the succeeding series of disturbances which, with greatly diminished intensity and at increasing intervals of time, continued to maintain the conditions of alarm and terror into which the people of the afflicted locality were naturally thrown by the first disturbance. Although some injury to buildings resulted from these after shocks, it is tolerably certain that in all such cases displacement and fracture had taken place in the great shock; the lesser disturbances simply finishing what had then been nearly completed.

The origin of the disturbances appears to have been somewhere below a point fifteen or twenty miles northwest of Charleston; that is, in the neighborhood of the town of Summerville. A chart of provisional co-seismal lines drawn by Mr. Hayden of the Geological Survey, and published in "Science" for September 10th, seems to locate this centre somewhat further north than the point indicated above. At the time of its construction, however, information from many points was lacking, and that which was at hand was admitedly doubtful in some degree.

Reference will be made later to the iso-seismal chart accompanying this report, which indicates that the origin was near the point referred to above. Strong proof of this is also furnished in the intensity and character of the disturbance as shown by the effects which were still visible when an examination was made a few days after the principal shock. The appearance of brick piers upon which many houses in Summerville rest was such as to justify the conclusion that the principal component of the motion at that point was vertical, and it was evident that the destruction of buildings was much less than would have resulted from a horizontal movement equal to that which had taken place in Charleston and elsewhere in the neighborhood.

Another fact of importance is that in the vicinity of Summerville the disturbances preceding that of August 31st took place, and here they have been most numerous and most persistent. Indeed, at the present writing, nearly a month after the first perceptible shock, they still occur at irregular intervals varying from a few hours to a few days. Only the most violent of these have been felt as far as Charleston.

Nearly all the movements in Summerville and vicinity have been accompanied by, and, indeed, generally preceded by, a low rumbling sound, lasting one or two seconds, and not infrequently this sound, always unmistakable in its character, was neither accompanied nor followed by a perceptible movement. This was a common occurrence at Summerville and in the immediate vicinity, and it was found that among several observers there would be no agreement upon the direction from which the sound appeared to come.

At a distance from ten to fifteen miles from Charleston in the direction of Summerville some of the most curious and interesting effects of the disturbance were to be seen. These were the "sand craters" and crevices, out of which extensive eruptions of sand and water had taken place on the night of August 31st. The craters thus formed varied in size from an irregular oval, twenty-five feet long by fifteen feet wide, to shallow cones not over an inch in diameter and beautifully symmetrical in form. The area surrounding these openings was generally flooded with sand, often acres in extent, to a

depth varying from a fraction of an inch to fifteen and eighteen inches. About the larger cavities the average depth was probably not less than six inches, and the area covered often an acre or more. The flow of sand was unquestionably only an incident to the outflowing of vast quantities of water, the greater part of which disappeared within a few hours after its appearance. The few crevices or "cracks" in the earth which were found were in character and origin similar to the "craters," being long and narrow openings, through which water with sand had been ejected.

It was difficult, in fact quite impossible, to obtain reliable information concerning the nature of this phenomenon at the moment of its occurrence. The locality in which it was principally exhibited is near a station on the South Carolina Railway, between Charleston and Summerville, known as "Ten-mile Hill." It is thinly populated and almost entirely by negroes. Several persons who pretended to have been eye-witnesses of the outburst gave widely different testimony as to its character. According to one account the water and sand from one of the "geysers" spouted to a height greater than that of a telegraph pole and continued to flow for four or five hours. Another, and apparently an equally credible witness, declared that the stream reached a height of six or eight feet, and that the flow continued four or five minutes. The latter statement is probably nearer the truth than the former.

A few instances of sand eruptions were found in the city of Charleston, and a few also at Summerville, and at the latter place water continued to flow from one of the openings for several days after the first shock.

It is important to observe that in no case was it found that the water thus issuing from the earth was hot or noticeably above the temperature of water in shallow wells in the neighborhood. Reports of boiling water having been thrown up were very numerous, but no evidence that the water was really hot appeared. The use of the word "boiling" doubtless grew out of the appearance of the water as it issued from the openings and was probably used by eye-witnesses to describe this appearance with no reference whatever to temperature.

There were also reports of the appearance of blue flames in the neighborhood of these eruptions, but no reliable testimony to their existence could be obtained. There was also a report that was circulated extensively through the medium of the press of the country that two or three showers of hot stones had fallen upon and near the office of the "Charleston News and Courier.". An examination of some of these shortly after they had fallen forced the conviction that the public was being made the victim of a practical joke.

In the city of Charleston about forty lives were lost. The greater number of casualties resulted from injuries sustained by persons who were either in the street at the time of the shock or who rushed out and were caught by the falling débris. No adequate description of the injury to property can be given in this place and, indeed, the results of this earthquake have been so thoroughly considered in the public press that note is unnecessary.

While there was probably not a single house in the city which was not in some degree affected by the shock of August 31st there was naturally great diversity as to the extent of the damage in different localities. Some parts of the city are built upon what is called "made land," resulting in many cases from the filling up of old creek bottoms and from other extensive leveling and grading. A more careful study of these peculiarities and their distribution may lead to the discovery of some relation between local differences in structure and the areas of greatest destruction.

Unquestionably much is to be attributed to the difference in the character of the buildings themselves, and to the relation of their lines of greatest or least strength to the direction of the wave front. As was to be expected, buildings constructed of wood suffered much less than those of brick. The interior of wooden buildings, however, would often exhibit a scene of total destruction, furniture, book-cases, etc., having evidently been moved with great violence. A very brief examination of injured buildings sufficed to establish, in a general way, the principal direction of the movement, which was probably in a northwest and southeast line.

The probability of the destruction of a building depends so largely on conditions other than the amplitude or direction of the vibration of the earth particle that the study of destroyed or damaged structures can yield little exact information concerning these elements. The displacement of bodies of simple form and structure, lying near to or upon the surface of the earth itself, is a vastly more reliable index of the direction and intensity of the disturbance. In the church yards of Charleston many instances of displacement and overturned monuments, columns, urns, etc., were found. These were examined with some care, and a careful study of the results may bring out some information concerning the dynamics of the earthquake. A cemetery containing many pyramidal or cylindrical shafts resting upon flat stone bases is tolerably certain, when disturbed by an earthquake, to exhibit not only displacement but also instances of twisting about a vertical axis; cases of of this kind were numerous at Charleston. Such rotations by no means imply a similar gyratory motion of the earth, as it is well known that they may result, and doubtless always do, from vibratory motions in a single plane. It was not at all uncommon to find two columns, very near to each other, twisted in opposite directions.

The table given below contains a resumé of information received at the office of the Chief Signal Officer from regular observers of the Service and from a number of voluntary observers. The place, time, supposed direction, duration, and estimated intensity are given. Much discrepancy will be observed in the records of time. Confusion is especially great in a few portions of the country in which so called "local time" is still adhered to. Whenever "standard time" is known to have been used reduction has been made to that of the 75th meridian. In a few cases, however, no reasonable supposition will explain the discrepancies. Such records must be erroneous.

A study of this column will show the great importance, in making such observations, of determining the error of the clock or watch at the earliest possible moment by comparison with the time of some known meridian. It must be said, however, that the extended use of standard time has rendered these results vastly more accurate than they otherwise would have been. Telegraphic time-signals are now within the reach of most people, and during the past two or three years a great improvement in the accuracy of time-keeping among the people has taken place.

The direction of the movement recorded against each station is that given by the observer. As it is based in many instances on the motions of swinging objects, or easily movable objects, it is of necessity often erroneous. In the absence of correct instrumental records, however, such observations are of value. The numbers expressing the intensity of the disturbance were applied at this office, from descriptions furnished by obsevers, according to a scale adopted by the Director of the Geological Survey.

This scale is as follows:

No. 1. Very light. Noticed by a few persons; not generally felt.

No. 2. Light. Felt by the majority of persons; rattling windows and crockery.

No. 3. Moderate. Sufficient to set suspended objects, chandeliers, etc., swinging, or to overthrow light objects.

No. 4. Strong. Sufficient to crack the plaster in houses, or to throw down some bricks from chimneys.

No. 5. Severe. Overthrowing chimneys and injuring the walls of houses.

With these intensity numbers an attempt has been made to plot a chart of iso-seismal lines, or lines of equal intensity. The result is shown in chart number vii. Nothing short of the use of well-constructed seismographs can furnish satisfactory measures of the amplitude of vibrations of the earth particle or

the maximum velocity of the same, but in the absence of records of such instruments, this chart or a more perfect one constructed upon the same plan, will afford opportunity for study.

In conclusion, it ought to be stated that this brief review of the Charleston earthquake must be regarded only as an attempt to place some of the leading facts upon record, for the benefit of the readers of the MONTHLY WEATHER REVIEW. It is in no way intended to anticipate the investigations now in progress by the United States Geological Survey, a full report from which, based upon all attainable information, will be looked for with great interest.

Summary of reports from observers.—Earthquake of August 31, 1886.

Station.	Latitude.	Longitude.	Time.	Duration.	Intensity.	Direction.	Observer.
	° ′	° ′	Hour.	Sec.			
Albany, N. Y.*	42 39	73 45	10.01	.....	2	s to nw.	J. O. Barnes.
Arlington, Tenn.*	36 00	86 45	9.50	60	1	n. to s.	W. C. Morris.
Atlanta, Ga	33 45	84 23	9.50	300	4	.....	W. Easby Smith.
Atlantic City, N. J	39 22	74 25	9.55	30	.....	s.	A. J. Mitchell.
Auburn, Ala*	32 38	85 28	8.52	300	3	e. to w.	J. C. Perkins.
Augusta, Ga	33 28	81 54	9.51	90	4	e. to w.	D. Fisher.
Baltimore, Md	39 18	76 37	9.50	60	2	.....	Geo. W. Felger.
Batesville, Miss	34 23	89 50	.....	20	3	n., s.	H. Harris.
Beaver, Ohio	39 00	82 51	.....	30	2	.....	J. M. Grether.
Buchtel, Ohio	39 29	82 15	9.30	120	1	.....	John Maurer.
Cairo, Ill.†	37 00	89 10	9.53	50	2	se. to nw.	C. L. Bozzell.
Cape Henry, N. C	36 56	76 00	9.50	.....	2	.....	Wm. Davis.
Cormit, Miss	.....	.....	9.55	30	.....	.....	T. E. Henry.
Carrollton, Ala	33 15	88 03	8.50	4	3	e. to w.	M. L. Stansel.
Cedar Keys, Fla	29 08	83 02	9.56	105	2	se. to nw.	W. W. Thomas.
Centre, Ala	34 09	85 42	9. 0	.....	3	.....	Thos. Bradford.
Charleston, S. C.*	32 47	79 56	9.51	22	5	e. to w.	J. H. Smith.
Charlestown, W. Va	39 18	77 49	9.55	.....	2	.....	New York "Sun."
Chattanooga, Tenn	35 04	85 15	9.50	20	2	e. to w.	"Times."
Do.†	do....	do....	9.53	.....	3	sw. to ne.	Edward A. Beals.
Charlotte, N. C	35 13	80 51	9.54	120	4	.....	James A. Barry.
Cheraw, S. C.*	34 41	79 54	9.50	120	5	w. to e.	W. L. Godfrey.
Chicago, Ill	41 52	87 38	10.00	7	1	w. to e.	Allen Buell.
Chincoteague, Va	37 55	75 23	.....	.....	2	.....	A. B. Crane.
Do	do....	do....	10.36	.....	1	.....	.....
Cincinnati, Ohio	39 06	84 30	9.13	.....	1	.....	P. T. Jenkins.
Cleveland, Ohio	41 30	81 42	9.54	.....	1	.....	Wm. Line.
Columbia, S. C	34 00	81 06	9.51	.....	5	.....	Robert W. Shand.
Columbus, Ohio*	39 58	83 00	9.53	105	2	n. to s.	H. R. Gill.
Do	do....	do....	9.52	.....	1	nw. to se.	A. L. McRae.
Columbus, Ga	32 27	84 54	9.56	46	3	.....	"Enquirer-Sun."
Covington, Tenn	35 30	89 36	9.55	3	1	.....	D. T. Flannery.
Connersville, Ind	39 33	85 05	9.52	25	3	n. to s.	Robert Ressler.
Dale Enterprise, Va.*	38 30	78 42	9.55	.....	3	e. to w.	L. J. Heathwole.
Danville, Va	36 36	79 24	10.05	.....	.....	.....	"Daily Dispatch."
Davenport, Iowa	41 30	90 38	10.00	1	1	se. to nw.	Robert R. Marten.
Decatur, Ala	34 35	86 55	9.53	.....	.....	se. to nw.	A. C. Frey.
Detroit, Mich	42 20	83 03	9.58	.....	1	.....	H. McP. Baldwin.
Do	do....	do....	9.58	15	1	.....	N. B. Conger.
Diamond, Ga	34 41	84 15	.....	.....	4	.....	W. W. Ringey.
Dubuque, Iowa	42 30	90 44	9.02	10	1	.....	S. E. Emery.
Dyersburg, Tenn	36 03	89 24	9.54	10	3	sse.	Louis Hughes.
Do	do....	do....	.....	.....	3	n. to s.	S. G. Parker.
Enfield, N. C.†	36 10	77 40	.....	18	3	.....	John Goodrich.
Elberton, Ga	34 04	82 48	.....	10	3	w. to e.	Louis Dorman.
Florence, Ala	34 48	87 38	9.10	10	1	.....	J. W. Milner.
Fort Macon, N. C	34 42	76 40	9.43	25	2	s., sw.	Wm. Daly.
Gainesville, Ga.*	34 22	83 48	9.15	45	4	w. to e.	C. B. La Hatte.
Grand Haven, Mich	43 05	86 18	9.46	5	1	e. to w.	Joseph E. Mueller.
Grand Junction, Tenn	35 04	89 10	9.55	.....	2	.....	J. B. Irwin.
Greensborough, Ala	32 43	87 36	9.	.....	2	.....	"Daily Dispatch."
Gloversville, N. Y	43 03	74 22	10.00	.....	2	se. to nw.	L. W. Chamberlin.
Hartford, Conn.*	41 31	72 21	9.54	.....	3	.....	A. H. Eddy.
Hatteras, N. C	35 15	75 40	10.00	60	3	sw. to ne.	Arthur S. White.
Hollow (?) Springs, Tenn	36 36	86 22	10.00	60	1	.....	N. F. Bryant.
Indianapolis, Ind.*	39 46	86 10	9.55	8	2	.....	C. F. R. Wappenhans.
Ithica, N. Y	42 24	76 36	9.55	.....	2	.....	"New York Tribune."
Jacksonville, Fla	30 20	81 39	8.45	.....	2	.....	New York "Sun."
Do	do. ..	do....	9.52	90	3	e. to w.	J. W. Smith.
Kitty Hawk, N. C	36 00	75 42	10.00	5	.....	.....	P. W. Fitzmaurice.
Knoxville, Tenn.†	35 56	83 58	9.55	30	2	e. to w.	W. O. Bailey.
Lincoln, Ohio†	38 45	82 19	.....	10	2	s.	M. M. Walter.
Lincolnton, N. C	35 29	81 12	9.55	75	3	.....	Dr. L. R. Standemeyer.
London, Ont	42 59	81 15	.....	30	2	.....	"New York Herald."
Louisville, Ky	38 15	85 45	9.13	.....	2	se. to nw.	Frank Burke.
Lynchburg, Va	37 25	79 09	9.50	.....	2	.....	"Daily Dispatch."
Do	do....	do....	9.55	120	3	.....	Thos. S. Schley.
Mansfield, Ohio	40 46	82 29	9.30	.....	1	.....	"Daily Dispatch."
Mapleton, S. C.*	33 51	82 19	.....	180	5	.....	Wm. Bradley.
Manington, Ky	.....	.....	9.15	60	1	.....	J. H. Allen.
Memphis, Tenn	35 09	90 03	.....	.....	20	3	.....
Do.*	do....	do....	9.55	10	2	ne. to sw.	D. T. Flannery.
Do	do....	do....	9.55	7	3	.....	F. Zimmerman.
Do	do....	do....	.....	.....	.....	e. to w.	Christian Bros. College.
Do	do....	do....	9.57	.....	3	.....	J. P. Young.
Do	do....	do....	9.55	20	3	e. to w.	W. Harvey.
Do	do....	do....	9.53	10	2	w. to e.	E. Lippencott.
Do	do....	do....	9.55	.....	2	w. to e.	R. G. Latting.
Do	do....	do....	.....	60	.....	w. to s.	A. G. Watts.
Do	do....	do....	.....	30	.....	ne. to sw.	O. M. Peck.
Do.*	do....	do....	.....	20	2	.....	W. H. Stillwell.
Do	do.	do....	9.50	90	1	se. to nw.	Don. Wishart.
Milan, Tenn	35 56	88 58	9.57	.....	3	sw. to ne.	O. F. Cantwell.
Mobile, Ala	30 41	88 02	.....	.....	1	.....	A. Pritchard.
Montgomery, Ala	32 23	86 18	9.56	32	3	se. to nw.	L. Dunne.
Do	do....	do....	9.55	.. ...	2	.....	"Daily Dispatch."

Summary of reports from observers—Continued.

Station.	Latitude.	Longitude.	Time.	Duration.	Intensity.	Direction.	Observer.
	° ′	° ′	Hour.	Sec.			
Morristown, N. J	40 48	74 27	9.55	25	2	se. to nw.	Thos. J. Beans.
Mossy Creek, Ga	34 36	83 42	.....	840	1	.....	J. M. Dorsey.
Murphysborough, Ill	37 50	89 21	.....	.....	2	.....	.....
Nashville, Tenn	36 10	86 47	9.54 30	60	2	n., e.	L. N. Jesunofsky.
New Haven, Conn	41 18	72 50	9.55 30	.....	1	.....	J. H. Sherman.
New London, Conn	41 21	72 05	.....	.....	.....	.....	W. A. Olds.
New River, N. C.†	.....	.....	9.50	.....	.....	.....	E. E. Perry.
New York City	40 43	74 00	9.55	60	3	.....	S. H. Hurd.
Do	do....	do....	9.53	60	2	nw., se.	H. J. Penrod.
Norfolk, Va	36 51	70 17	9.45	90	2	.....	"Daily Dispatch."
Do	do....	do....	9.54	15	3	s. to n.	James P. Sherry.
Do	do....	do....	.....	35	1	s., sw.	J. H. Teerney.
Norwood, N. C.†	35 15	80 03	9.30	120	4	e.	J. W. Wright.
Oswichee, Ala	32 10	85 00	9.00	.....	2	.....	W. C. Whitaker.
Opelika, Ala.*	32 38	85 23	9.55	20	4	.....	G. E. Webber.
Oxford, Miss	34 20	89 26	9.57	60	2	e. to w.	"University."
Paducah, Ky	37 05	88 36	.....	15	.....	.....	.....
Paris, Tenn.†	36 18	88 21	9.56	60	.....	sw. to ne.	J. P. Chambers.
Do	do....	do....	9.56	30	.....	.....	E. P. Wood. C. A. Davis.
Pensacola, Fla	30 25	87 13	10.00	30	1	.....	W. L. Widmoyer.
Petersburg, Va	37 14	77 22	10.(?)	.....	2	.....	"Daily Dispatch."
Petrolea, Ont	42 51	82 09	.....	.....	1	.....	"New York Herald."
Philadelphia, Pa	39 57	75 09	9.50	60	2	e. to w.	L. W. Dey.
Pittsburg, Pa	40 32	80 02	9.55	60	1	.....	O. D. Stewart.
Pekin, Ill	40 35	89 39	.....	.....	1	.....	J. E. Terborg.
Plainfield, N. J	40 14	74 25	9.56	.....	2	n. to s.	"Daily Dispatch."
Plum Branch, S. C.*	.....	.....	.....	600	3	nw. to ne.	S. E. Freeland.
Port Huron, Mich	42 58	82 29	9 55	.....	1	.....	W. M. Edmondson.
Raleigh, N. C	35 46	78 39	9.50	.....	2	.....	New York "Sun."
Do.*	do....	do....	9.50	120	5	.....	Thos. C. Harris.
Do *	do....	do....	10.05	30	3	.....	Thos. C. Harris.
Rassetter, Fla	28 58	81 22	.....	.....	2	.....	H. V. Nosgky.
Rappahannock Station, Va*	38 30	77 45	.....	30	3 3	e. to w. se. to sw.	W. H. Ireland.
Richmond, Va	37 32	77 22	9.55	.....	2	.....	"Daily Dispatch."
Rockland, Ohio	39 17	81 30	.....	.....	2	.....	T. V. McTaggart.
Rutherfordton, N. C.†	35 24	81 50	9.50	150	4	.....	Albert L. Grayson.
Sandy Hook, N. J	40 28	74 01	9.45	60	.....	ne. to sw.	Frank Ridgway.
Sanford, Fla	28 48	81 23	9.50	10	3	w. to e.	Henry Pennywitt.
Savannah, Ga.†	32 05	81 08	9.52	75	4	sw. to ne.	Richard Graham.
Saulsbury, Tenn	35 03	89 02	.....	20	2	se. to nw.	R. M. Bostwick.
Scottsborough, Ala	34 38	86 00	.....	.....	2	se. to nw.	W. A. Anderson.
Selma, Ala	32 24	87 00	9.00	.....	2	e. to w.	"Daily Dispatch."
Smithville, N. C*	33 55	73 01	9.50	10	4	nw. to se.	F. P. Chaffee.
Somerset, Ky	37 06	84 42	9.59	60	2	w. to e.	S. Whenery.
Soapstone, N. C	35 48	79 36	.....	.....	3	.....	H. L. Kinney.
Saint Louis, Mo	38 38	90 12	8.20	.....	1	.....	"Globe Democrat."
Do.*	do....	do....	9.25	.....	1	.....	G. A. Webber.
Toledo, Ohio	41 40	83 32	9.20	.....	1	.....	A. E. Fraser.
Tracy City, Tenn	35 16	85 48	9.50	.....	3	w. to e.	W. T. Thomas.
Triangle, S. C.†	33 30	80 20	.....	.....	4	.....	Wm. B. Smith.
Tuskegee, Ala	32 20	85 39	8.30	60	2	.....	"Daily Dispatch."
Union Springs, Ala	32 07	85 43	9.00	30	2	.....	J. L. Moultrie.
Valley Head, Ala	34 36	85 36	9.00	60	.....	.....	E. P. Nickolson.
Vevay, Ind	38 45	85 03	9.10	.....	.....	ne. to sw.	Charles G. Boerner.
Do	do....	do....	9.25	.....	.....	.....	.....
Do.*	do....	do....	9.45	.....	3	.....	.....
Vicksburg, Miss	32 23	90 54	10.05	45	3	s. to n.	John W. Byram.
Walthourville, Ga	31 46	81 36	9.30	75	4	s. or se.	John L. Harden.
Washington City	38 53	77 01	9.55	40	.....	n. to s.	T. B. Harrison.
Do*	do....	do....	9.53	23	4	n. to s.	Alex. McAdie.
Wetumpka, Ala	32 32	86 12	9.00	.....	2	.....	"Daily Dispatch."
Weldon, N. C	36 27	77 38	9.50	.....	.....	.....	F. A. Clark.
Willow Grove, W. Va	38 54	81 54	9.32	.....	2	.....	J. N. Trimble.
Wilmington, N. C	34 11	78 10	9.50	25	3	nw.	W. H. Fallon.
Woodbury, N. J	39 39	75 18	9.57	6	.....	.....	Edward Brown.

* Accompanied by noise. † Preceded by noise.

In addition to the above earthquake in the United States on the 31st, the following reports have been received:

Indianapolis, Indiana: a slight earthquake shock was felt here on the afternoon of the 13th. The motion continued about twelve seconds.

The following is from the "New York Herald" of August 13th:

QUEBEC, *August* 12, 1886.—Early on Wednesday morning a sharp shock of earthquake was felt at Ste. Marguerite, Ste. Adèle, and St. Sauveur. A barn at the first named place was shaken down, and other buildings were slightly damaged. The shocks lasted about six minutes. A violent wind and hail storm prevailed at the time.

The following is from the "New York Tribune" of August 16th:

LONDON, *August* 16.—Three shocks of earthquake were felt in Malta yesterday at intervals of eight hours. No daamge was done, but the people were greatly alarmed.

The following is from the "Erie Morning Dispatch" of August 21st:

LONDON, *August* 16.—Three shocks of earthquake has been felt at Malta. The captain of a steamer which has arrived there reports that on Tuesday, two hundred miles east of Malta, he witnessed the upheaval of a column of water thirty feet in diameter to a distance of two hundred feet.

The following is from the "New York Tribune" of August 22d:

EDINBURG, *August* 21.—Kilsyth, in Sterling county, Scotland, was visited to-day by a shock of earthquake. The shock was slight.

The following reports are from the "New York World" of August 29th:

ALEXANDRIA, *August* 28.—Violent shocks of earthquake have been experienced here and in other parts of Egypt, causing terror among the natives, but so far as known doing no serious damage.

ROME, *August* 28.—Several towns in Italy were also visited by the earthquake, but not to any serious extent. Naples, Brindisi, Foggia, Caserta, and Taranto being of the number. Later despatches say that among the towns in Italy where the earthquake was felt are Syracuse, Reggio, Calabria, Potenza, Pozzuoli, Bari, and Avellino. The people were panic stricken, and took refuge in the fields and churches.

The following reports of earthquake are from the "New York Herald" of August 30th:

NAPLES *August* 29, 1886.—Vesuvius is again in a state of eruption. The people of Naples and Bari are fleeing to the country or gathering in the open spaces.

ATHENS, *August* 29, 1886.—The area of the earth disturbance in Greece yesterday was phenomenally wide. At least six towns were entirely destroyed and score of others were partially destroyed. On the mainland much damage was done, but there was little loss of life. On the islands it is estimated that six hundred persons were killed and one thousand seriously injured. The undulations were curiously regular. The actual shocks averaged twelve seconds in duration.

FOREST AND PRAIRIE FIRES.

Forest City, Potter county, Dakota: during the 1st, 2d, and 3d prairie fires were burning in this county. The fire burned over twenty miles of the Missouri River bottom lands and destroyed much agricultural property.

Escanaba, Michigan: on the 8th, 9th, 10th, and 11th disastrous forest fires were burning at Stevenson, thirty miles southwest of this town. At 4 p. m. of the 8th the smoke became so dense at Escanaba that the sun was completely hidden from view, as it was also during the greater part of the 9th. On the 10th the fires were burning along the line of the Chicago and Northwestern Railroad.

Cheboygan, Cheboygan county, Michigan, 9th: the forest that nearly surrounds the town is burning rapidly and the sky is overcast with smoke.

Fort Assinaboine, Montana: from the 9th to the 26th prairie fires in this vicinity burned over an area of not less than four hundred square miles of the best grazing land in Montana, and destroyed much valuable pine timber in the Bear Paw and Little Rocky Mountains. On the 26th light rain fell from 2.40 to 7.22 p. m., extinguishing the fires.

Traverse City, Michigan: on the 11th destructive forest fires were burning near this place and along the line of the Central Railroad, from Bay City to Mackinaw. Fences, farm houses, saw-mills, and millions of feet of lumber have been burned, The fire extended over a large area, including Calmut, Clark, and Marathon counties; in these counties hundreds of families are reported to have been made homeless by the fires.

Milwaukee, Wisconsin, 16th: during the past week very disastrous forest fires have been burning in northern and middle Wisconsin. The greatest damage was to standing timber, which is the source of wealth in this district. The drought has continued so long that leaves have withered and fallen weeks before their usual time, swamps and marshes have dried, creeks have disappeared, and larger streams are reduced in size. Everything, therefore, is perfectly dry and the fire spreads, with nothing to impede its progress.

Oconto, Oconto county, Wisconsin, 16th: during the past week disastrous forest fires have been burning along the line of the Chicago and Northwestern Railroad. The fire consumes the underbrush and dead trees and kills the green ones. Many hundreds of acres of forest have been destroyed. A number of farm houses and barns have been burned. North of the town of Velp, and toward the northwest over an area twelve miles wide, the woods are burning rapidly; owing to the fact that this forest was burned over by a former fire which killed the green trees but did not consume them, this fire spread with unusual rapidity, destroying numerous farm houses and compelling the occupants to remove their household effects to the centre of ploughed fields for safety. In the vicinity of Big Suamico, near Green Bay, farmers have lost nearly all their property, the fire destroying fences, barns, and stacks of hay and wheat. In Eaton township twenty-seven houses were burned. It is estimated that property to the amount of $200,000, not including the value of the timber, has been destroyed in Brown county alone. From the village of De Pere the fire extended toward the north for miles, burning dwellings, saw-mills and barns. Owing to the long drought all underbrush was very dry, allowing the fire to spread rapidly.

Genoa, Platte county, Nebraska: the observer at this place makes the following report in reference to the state of the atmosphere on the 26th, 27th, and 28th:

> About 7 p. m. of the 26th the wind steered suddenly from the south to north and northwest, and rolled over the town a dense cloud of what proved to be smoke, having the peculiar smell of burning vegetation; this smokiness of the atmosphere continued during the 27th and 28th. No fires have occurred in this vicinity, and therefore the smoke must have proceeded from the burning forests in Wisconsin.

East Portland, Oregon: throughout the month the atmosphere has been filled with smoke from forest fires; 2,000 cords of wood were burned, as well as many acres of valuable forest.

Forest and prairie fires have also been reported from the following places:

Marquette, Michigan: forest fires, 8th to 11th.
Mount Angel, Oregon: forest fire, 4th.
Portland, Oregon: forest fires, 1st, 3d, 4th, 5th, 11th, 27th.
Philipsburg, Pennsylvania: forest fire, 21st.
Embarras, Wisconsin: forest fire, 3d.
San Antonio, Texas: prairie fire, 3d.
Moorhead, Minnesota: prairie fire, 28th.
Saint Vincent, Minnesota: prairie fires, 25th, 26th, 28th, 31st.
Fort Buford, Dakota: prairie fires, 19th, 20th.
Yankton, Dakota: prairie fires, 28th, 29th.
Huron, Dakota: prairie fires, 27th, 28th.
Fort Shaw, Montana: prairie fire, 24th.
Poplar River, Montana: prairie fires, 18th, 19th, 21st.
Fort Maginnis, Montana: forest fires, 22d, 28th.
Fort Cœur d'Alene, Idaho: forest fires, 16th, 17th, 18th, 20th, 24th.
Boisé City, Idaho: forest fires, 21st, 22d.
Walla Walla, Washington Territory: forest fires, 19th.
Fort Reno, Indian Territory: prairie fires, 15th, 26th, 27th.

METEORS.

Variety Mills, Nelson county, Virginia: on the 2d, at 9 p. m., a very bright meteor, followed by a long train, passed across the sky near the zenith, from north-northeast to south-southwest.

Nicolaus, Sutter county, California: at 7.30 p. m. of the 3d a meteor of the apparent size of a bucket passed from the south directly over the town. Balls of fire and sparks were constantly dropping from the meteor; it was followed by a brilliant train.

Moorestown, New Jersey: on the 26th, at 8.04 p. m., a meteor, four times the size of Venus, passed from the west of Ursa Major and burst into two fragments and disappeared when in constellation Cassiopeia.

Beverly, Burlington county, New Jersey: on the 26th, at 8.03 p. m., a white meteor, about half the size of the new moon, passed from west to east at an average altitude of 80°. The meteor was visible about five seconds and disappeared in the east. This meteor was also seen at Haddonfield, Clayton, and Woodbury, New Jersey.

Mobile, Alabama: about 9.45 p. m. of the 31st a very brilliant meteoric display was observed in the western horizon; it passed across the sky from east to west, appearing at intervals in the form of a ball of fire. The display continued about forty-five seconds.

Meteors were also reported, as follows:

California.—Fort Bidwell, 4th.

Dakota.—Webster, 10th, 11th, 25th, 29th, 30th.
Florida.—Key West, 1st; Limona, 2d, 17th, 18th, 19th, 23d; Archer, 10th, 18th, 22d, 27th, 28th; Alva, 10th, 19th, 20th, 21st.
Illinois.—Charleston, 19th, 22d, 25th, 28th; Windsor, 27th.
Indiana.—Vevay, 25th, 26th.
Iowa.—Davenport, 6th, 8th, 9th, 15th, 24th, 26th.
Kansas.—Allison, 3d to 31st; Topeka and Wilmington, 10th.
Maryland.—Fallston, 20th; Fort McHenry, 21st; Woodstock, 23d; Baltimore, 26th.
Massachusetts.—Cottage City, 11th; Somerset, 23d.
Michigan.—Mackinaw City, 1st; Kalamazoo, 2d, 7th, 11th, 25th, 27th, 28th, 30th.
New Hampshire.—Nashua, 10th.
New Jersey.—Egg Harbor City, 2d, 3d; Clayton, 3d, 23d; Beverly, 9th, 10th; Dover, 20th, 28th, 29th; Upper Montclair, 30th.
New York.—North Volney, 3d; Mountainville, 3d, 4th, 17th, 23d; Albany, 10th.
Ohio.—Napoleon, 10th; Jacksonborough, 28th.
Oregon.—Mount Angel, 10th.
Pennsylvania.—Pittsburg, 21st; Dyberry, 26th.
South Carolina.—Stateburg, 3d; Spartanburg, 28th; Aiken, 30th.
Texas.—Cleburne, 7th, 10th, 16th, 17th, 18th, 21st to 24th, 28th.
Vermont.—Strafford, 4th.
Virginia.—Chincoteague, 2d, 13th; Variety Mills, 2d; Dale Enterprise, 26th; Rappahannock, Station, 9th, 12th, 16th, 18th.

POLAR BANDS.

Polar bands were reported during the month from the following stations:
Archer, Florida, 1st, 2d, 6th, 31st.
Riley, Illinois, 15th, 21st.
Salina, Kansas, 19th, 22d, 24th.
Beverly, New Jersey, 4th.
Napoleon, Ohio, 8th.
Wauseon, Ohio, 18th.
Wytheville, Virginia, 2d, 3d, 13th.
Prairie du Chien, Wisconsin, 17th.

SAND STORMS.

Fort McDowell, Arizona, 10th, 13th, 22d, 24th.
Yuma, Arizona, 25th.

SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for August, 1886:

Date—August, 1886. Standard time.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 3 p. m.	1	3	0	0	1	3	4	50‡	
2, 4 p. m.	0	4	2	5‡	.....	.....	3	45‡	
6, 9 a. m.	.....	.....	.....	.....	.....	.....	2	35‡	
8, 2 p. m.	.....	.....	.....	.....	.....	.....	1	5	
9, 5 p. m.	0	0	0	0	0	0	1	5	
10, 7 p. m.	0	0	0	0	0	0	1	4	
11, 4 p. m.	1	4	0	3	1	4	2	5	
12, 3 p. m.	0	0	1	1	0	0	1	4	
14, 10 a. m.	0	0	0	0	0	0	1	4	
15, 5 p. m.	0	0	0	0	0	0	1	3	
17, 9 a. m.	0	0	0	0	0	0	1	3	
18, 5 p. m.	1	3	0	0	0	0	2	6	
20, 4 p. m.	1	1	.....	.....	0	0	2	2	
21, 6 p. m.	1	1	0	0	1	1	1	1	Small spot.
22, 3 p. m.	1	1	0	0	1	1	1	1	Small spot.
23, 7 a. m.	0	0	0	0	0	0	1	1	Small spot.
24, 12 m.	0	2	0	0	0	0	1	3	Small spots.
26, 11 a. m.	0	10‡	0	0	0	0	1	13‡	
27, 4 p. m.	0	12‡	0	0	0	0	1	25‡	
28, 5 p. m.	0	5‡	0	0	0	0	1	30‡	
29, 6 a. m.	0	0	0	0	0	0	1	15‡	
29, 3 p. m.	0	0	0	0	0	0	1	10‡	

Faculæ were seen at the time of every observation. ‡Approximated.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 1st to 4th, 6th, 7th, 9th, 10th, 11th, 13th, 18th, 19th, 26th, 27th, 31st.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,948 observations to have been made, of which five were reported doubtful; of the remainder, 4,943, there were 4,298, or 87.0 per cent., followed by the expected weather.

RED SUNSETS.

The following description of red sunsets is furnished by Prof. Cleveland Abbe, Assistant:

Red sunsets have been frequently looked for by me during July and August, 1886, but the following is the only case that has been noted:

August 21, 1886, on board steamer "G. W. Leary," steaming northward in middle of lower Chesapeake Bay, latitude N. 37° 10′, longitude W. 0° 50′ from Washington City, sunset clouds a few degrees high (watch about three minutes fast on Eastern time, and this correction applied to my record); 7 h. 0 m., suspected pink; 7 h. 3 m., decided pink glow, maximum altitude 15°; 7 h. 7 m., very rich yellow, and brightness generally increased, but pink rapidly fading; 7 h. 12 m., no pink visible, but pale salmon tint up to 8° altitude. August 22d, 23d, and 24th, in Washington City, suspected pink for a few minutes but no decided tint.

WATER-SPOUTS.

Pensacola, Florida: a water-spout was visible from the city at 6.30 a. m. of the 17th, near Santa Rosa Island in the Gulf. It resembled a solid column of dense black cloud, extending from the sky to the water. At one time the spout attained the diameter of forty feet. The phenomenon lasted about half an hour, during which time it assumed various forms.

The schooner "Nelson Bartlett," Capt. S. Watts, commanding, on the 22d, at 12 noon (Greenwich mean time), in N. 8° 02′, W. 47° 17′, passed two water-spouts; wind south, weather clear.

Capt. Samuel Adamson, commanding the s. s. "Joshua Nicholson," reports having observed on August 28th, at 6 p. m. (Greenwich mean time), an immense water-spout off the north end of Fayal, Azores, which seemed to touch the north end of the island; it was accompanied with moderate squalls and torrents of rain, and was distant fifteen miles sse. of the vessel. The brig "Lilian," Capt. H. F. Schive, commanding, passed a heavy water-spout on the 5th, in N. 12° 50′, W. 57° 30′; wind strong from se., with rain.

VERIFICATIONS.

INDICATIONS.

The indications for August, 1886, were made by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant. The indications for the first twenty-five days of August, 1886, were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant; the remaining six days, by 2d Lieutenant J. P. Finley, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for August, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 75.36. The percentages for the different elements are: Weather, 74.22; wind, 70.78; temperature, 77.92. By states, etc., the percentages are: For Maine, 71.45; New Hampshire, 71.80; Vermont, 70.48; Massachusetts, 71.45; Rhode Island, 77.07; Connecticut, 75.59; New York, 77.31; Pennsylvania, 79.96; New Jersey, 81.16; Delaware, 75.54; Maryland, 79.28; District of Columbia, 78.63; Virginia, 75.73; North Carolina, 75.72; South Carolina, 73.31; Georgia, 73.65; Florida, 73.82; Alabama, 75.24; Mississippi, 72.88; Louisiana, 78.41; Texas, 86.48; Arkansas, 73.63; Tennessee, 66.88; Kentucky, 71.21; Ohio, 80.11; West Virginia, 79.01; Indiana, 75.70; Illinois, 77.33; Michigan, 82.04; Wisconsin, 74.48; Minnesota, 72.99; Iowa, 71.51; Kansas, 76.22; Nebraska, 69.49; Missouri, 76.18; Colorado, 62.34; east Dakota, 66.29.

There were three omissions to predict, out of 9,951, or 0.03 per cent. Of the 9,948 predictions that have been made, six hundred and sixty-three, or 6.66 per cent., are considered to have entirely failed; six hundred and two, or 6.05 per cent., were one-fourth verified; 1,858, or 18.68 per cent., were one-